

Claims

- 1) A device for the heating of a liquid in a beverage
5 machine comprising
 - at least one set of at least two resistors, wherein said resistors are electrically linked together so as to use one resistor of each set individually or in serial with one or more of the resistors of the same set
 - at least one individual resistor and at least one set of at least two resistors, wherein said resistors are electrically linked together so as to use the first resistor of a set individually or in serial with one or
10 more of the following resistors of the same set, said resistors transferring the maximum of energy to the flow of liquid and allowing a finer control of the liquid temperature.
- 20 2) A device according to claim 1, wherein the system of resistors is disposed on a tube, the liquid flowing in said tube.
- 25 3) A device according to claim 2, wherein it comprises further a cylindrical insert, which is disposed inside the tube, along its entire length and substantially along its axis of symmetry.
- 30 4) A device according to any of claims 2 or 3, wherein the insert comprises helicoidal grooves on its outside surface.
- 35 5) A device according to any of claims 2 to 4, wherein a spring is disposed around the insert.
- 6) A device according to any of claims 2 to 5, wherein the ratio of the length to the diameter of the tube is comprised between about 5 and about 40.

7) A device according to any of claims 3 to 5, wherein the insert is an insulated material, taken from the group consisting of plastic, metal and ceramic.

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8) A device according to any of claims 3, 4 or 7, wherein the insert is fixed or can be rotated along its axis of symmetry.

10 9) A device according to any of claims 3 to 8, wherein the insert is rotated because of its connection with a rotating wheel of a flowmeter disposed at the lower part of said insert.

15 10) A device according to claim 9, wherein the rotatable cylindrical insert comprises a wire brush.

11) A device according to claim 1, wherein the system of resistors is disposed on a flat base, liquid flowing through channels, which are positioned along the resistor tracks.

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12) A device according to claim 11, wherein the channels for the flowing of the liquid have a reduced section area, so that the liquid flow reaches a turbulent flow.

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13) A device according to any of claims 1 to 12, wherein the different electrical resistors are made in a form selected from the group consisting of wires, thick-film resistors.

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14) A device according to any of claims 1 to 13, wherein all the electrical resistors have a power density of up to 15 to 70 Watt/cm².

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15) A device according to any of claim 2, wherein the hollow tube comprises enamel painting on its outside under the resistors.

16) A device according to any of claims 1 to 15, wherein the electrical resistors are covered or insulated with an electrically non conductive material.

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17) An apparatus for the heating of a liquid comprising

- a liquid supply,
- a pump for supplying said liquid to
- a device for heating a liquid according to any of
- 10 claims 1 to 16, wherein said liquid flows from the water supply through a tube or channels in said apparatus,
- a way for the exit of heated liquid, either on a substance to be extracted or in a mixer to mix said
- 15 heated liquid with a powder.

18) A process for heating the system according to claim 17, wherein the electricity power in resistors and/or set of resistors is controlled so as to provide to the liquid

20 the required energy in real-time to reach the liquid target temperature according to the energy balance.

19) A process according to claim 18, wherein the flow-rate is comprised between 50 and 300 ml/min for a coffee

25 machine and between 300 and 5000 ml/min for a vending machine.